

CLAIMS

We claim:

1. A package comprising:

one or more surfaces;

a plurality of flexures attached to the one or more surfaces, each of the plurality of flexures having a body coupled to a plurality of legs via flexing spring regions, the flexing spring regions enabling legs of the plurality of legs on opposite sides of the body to spread further apart in response to a force on the body when not attached to the one or more surfaces; and

a plurality of optical elements, wherein each optical element in the plurality of optical elements is coupled to one of the plurality of flexures and the plurality of flexures are positioned such that the plurality of optical elements are in alignment with an optical axis.

2. The package in Claim 1 wherein one of the plurality of flexures comprises:

an optical component support having a pair of legs on opposite sides of a horizontal surface with at least one flexing spring region between each leg of the pair of legs and the horizontal surface; and

a base having a vertical surface to mount a first optical element and a channel having an opening opposite the vertical surface on the base for coupling a second optical element.

3. The package in Claim 2 wherein the base further comprises subtracted radius corners for handling the flexure.

4. The package in Claim 1 wherein at least one of the plurality of optical elements is an optical component selected from a group that includes an optical fiber, a laser, a lens, a modulator, a filter, a beam splitter, an isolator, a polarizer, a detector, and a grating.

5. The package in Claim 1 wherein the plurality of flexures includes a first flexure and a second flexure, wherein an optical fiber is attached to the first flexure and a lens is attached to the second flexure and is in optical alignment with the optical fiber.

6. The package in Claim 5 wherein one of the plurality of optical elements comprises an isolator, the isolator being attached to the second flexure and is in optical alignment with the lens.

7. The package in Claim 6 wherein the second flexure comprises a housing with a base coupled to the isolator to hold the isolator in optical alignment with the lens.

8. The package in Claim 5 wherein the second flexure comprises:

an optical component support having a pair of legs on opposite sides of a horizontal surface with at least one flexing spring region between each leg in the pair of legs and the horizontal surface; and

a base having a vertical surface to mount a first optical element and a channel having an opening opposite the vertical surface on the base for coupling a second optical element.

9. The package in Claim 8 wherein the base further comprises subtracted radius corners for handling the flexure.

10. The package in Claim 5 wherein the second flexure comprises:
an optical component support having a pair of legs on opposite sides of a horizontal surface with at least one flexing spring region between each leg in the pair of legs and the horizontal surface; and

a base having an inverted U-shape draping over the optical component support with a least one vertical surface to mount an optical element.

11. The package in Claim 10 wherein the base includes a horizontal surface and a plurality of corners of the base have extracted circular regions for handling.

12. The package in Claim 5 wherein the second flexure comprises:

an optical component support having a pair of legs on opposite sides of a horizontal surface with at least one flexing spring region between each leg in the horizontal surface; and

a base comprising a cube with an opening along the optical axis and including one or more vertical surfaces for mounting optical elements.

13. The package in Claim 5 wherein the second flexure comprises:

an optical component support having a pair of legs on opposite sides of a horizontal surface with at least one flexing spring region between each leg of the pair of legs and the horizontal surface; and

a base comprising a rod-shaped portion with an extension having a vertical surface to mount an optical element thereon and a horizontal extension to mount an optical element thereon.

14. The package in Claim 5 wherein the second flexure comprises:

an optical component support having a pair of legs on opposite sides of a horizontal surface with at least one flexing spring region between each leg of the pair of legs and the horizontal surface; and

a base comprising a rod-shaped base with a spherical radius top with a horizontal surface thereon for suction handling, wherein the rod-shaped base includes a vertical surface for mounting an optical element thereon and curved side surfaces for handling.

15. The package in Claim 5 wherein the second flexure comprises:

an optical component support having a pair of legs on opposite sides of a horizontal surface with at least one flexing spring region between each leg of the pair of legs and the horizontal surface; and

a base comprising a C-shaped base with a vertical surface to mount an optical element as well as a cavity the opposite side of the base in relation to the vertical surface, the cavity for mounting an optical element.

16. The package in Claim 5 further comprising a laser diode in optical alignment with the optical fiber and lens.

17. The package in Claim 16 further comprising a plate to which the first and second flexures are coupled.

18. The package in claim 5 further comprising a plate onto which the first and second flexures are coupled.

19. A package comprising:

a plurality of flexures attached to the one or more surfaces, each of the plurality of flexures having a body coupled to a plurality of legs via flexing spring regions, the flexing spring regions enabling legs of the plurality of legs on opposite sides of the body

to spread further apart in response to a force on the body when not attached to the one or more surfaces;

a plurality of optical elements, wherein each optical element in the plurality of optical elements is coupled to one of the plurality of flexures and the plurality of flexures are positioned such that the plurality of optical elements are in alignment with an optical axis, wherein the plurality of flexures includes a first flexure and a second flexure, wherein an optical fiber is attached to the first flexure and a lens and isolator are coupled to the second flexure and are in optical alignment with the optical fiber;

a laser diode in optical alignment with the optical fiber and lens; and

a plate to which the first and second flexures are coupled.

20. A method comprising:

positioning a first flexure such that one or more optical elements on the first flexure are in-line with an optical axis, including compressing the first flexure to cause flexure legs to spread apart for vertical alignment and moving the first flexure in one or more directions for horizontal alignment;

attaching the first flexure to a planar surface;

positioning a second flexure such that one or more optical elements on the second flexure are in-line with the optical axis; and

attaching the second flexure to the planar surface.

21. The method of claim 20, wherein positioning and attaching the first and second flexures is via laser welding.

22. An apparatus, comprising:

one or more surfaces;

a plurality of flexures, wherein at least one of the plurality of flexures comprises
a bridge with two or more legs extending from the bridge attached to the one or more surfaces, each of the plurality of flexures having a body coupled to a plurality of legs via flexing spring regions, the flexing spring regions enabling legs of the plurality of legs on opposite sides of the body to spread further apart in response to a force on the body when not attached to the one or more surfaces; and

at least one handling feature;

one or more surfaces to mount optical elements;

a base attached to the bridge with an end having a semi-circular radius.

23. The apparatus of claim 22, wherein the semi-circular radius contains a flat surface that is the handling feature.

24. The package defined in Claim 22 wherein the second flexure comprises:

an optical component support having a pair of legs on opposite sides of a horizontal surface with a flexing spring region between each leg and the horizontal surface; and

a base having a vertical surface to mount a first optical element and a channel having an opening opposite the vertical surface on the base for coupling a second optical element.

25. The package defined in Claim 24 wherein the base further comprises subtracted radius corners for handling the flexure.

26. The package defined in Claim 22 wherein the second flexure comprises:
an optical component support having a pair of legs on opposite sides of a horizontal surface with a flexing spring region between each leg and the horizontal surface; and

a base having an inverted U-shape draping over the optical component support with a least one vertical surface to mount an optical element.

27. The package defined in Claim 26 wherein the base includes a horizontal surface and a plurality corners of the base have extracted circular regions for handling.

28. The package defined in Claim 22 wherein the second flexure comprises:

an optical component support having a pair of legs on opposite sides of a horizontal surface with a flexing spring region between each leg and the horizontal surface; and

a base comprising a cube with an opening along the optical axis and including one or more vertical surfaces for mounting optical elements.

29. The package defined in Claim 22 wherein the second flexure comprises:

an optical component support having a pair of legs on opposite sides of a horizontal surface with a flexing spring region between each leg and the horizontal surface; and

a base comprising a rod-shaped portion with an extension having a vertical surface to mount an optical element thereon and a horizontal extension to mount an optical element thereon.

30. The package defined in Claim 22 wherein the second flexure comprises:

an optical component support having a pair of legs on opposite sides of a horizontal surface with a flexing spring region between each leg and the horizontal surface; and

a base comprising a rod-shaped base with a spherical radius top with a horizontal surface thereon for suction handling, wherein the rod-shaped base includes a vertical surface for mounting an optical element thereon and curved side surfaces for handling.

31. The package defined in Claim 22 wherein the second flexure comprises:
an optical component support having a pair of legs on opposite sides of a horizontal surface with a flexing spring region between each leg and the horizontal surface; and
a base comprising a C-shaped base with a vertical surface to mount an optical element as well as a cavity the opposite side of the base in relation to the vertical surface, the cavity for mounting an optical element.

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